THE IMPORTANCE OF COAL AND NATURAL GAS FOR INDONESIA

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ABSTRACT

Although Indonesia is endowed with varied energy resources, however from the availability of resources aspect coal and natural gas are considered as haring opportunity to be national main energy now and many years to come.

In the following, the importance of coal and natural gas for Indonesia is described.

1 INTRODUCTION

Energy resources have important role in national development. It functions as energy, raw material for domestic industry and source for foreign exchange. It suggests that the utilization of the energy should be efficient in order to get maximum net benefit for the society.

Indonesia is endowed with varied energy resources namely oil, natural gas, coal, geothermal, hydro and potential of renewable energy (biomass). Energy demand consumption increase in accordance with the fast development and significant rate of population growth. Within the last 30 years rate of energy consumption was very high more than average world consumption rate. In the early 1970s primary energy consumption only 50 million BOE while at the end of 1999 it reached 600.5 million BOE or growth rate of 19% annually. It also means that energy consumption growth rate higher than national economic growth, which is 6.8% per annum.

Using selected factor such as availability of resources role in national economy,

In addition, to certain extent prices, in the followings the importance of coal and natural gas is described.

2 COMPETING COAL AND NATURAL GAS

Based on those above conditions and to anticipate recent developments both at national and international level, energy policy *(Kebijaksanan Umum Bidang Energi,* KUBE) was devised in 1991 and was renewed in 1998. The policy consists of five principal elements namely: diversification, intensification in energy resource exploration, conservation, energy pricing, and environmental protection. These main elements are supported by supporting elements such as: investment, incentive and disincentive, standardization and certification, infrastructure development, human resources development, information system, research and development, institution building, and regulation.

Both coal and natural gas resources industry are generating social and economic benefits for Indonesia such as:

- employment for thousands Indonesians mostly in less developed areas of the country (Kalimantan and Sumatra), which will support the government's program for poverty alleviation;
- development of transportation infrastructure, local business and communities, in these less developed areas;
- a significant contribution to the country's balance of payment, in excess of US$ 1.5 billion per annum from export earnings;
- generation of substantial fiscal income for state and regional government

budgets, from a range of taxes and "royalties"; and
- transfer of technologies and skills which provides Indonesians with a range of benefits and new options for business ventures.

Reserves and Production

COAL

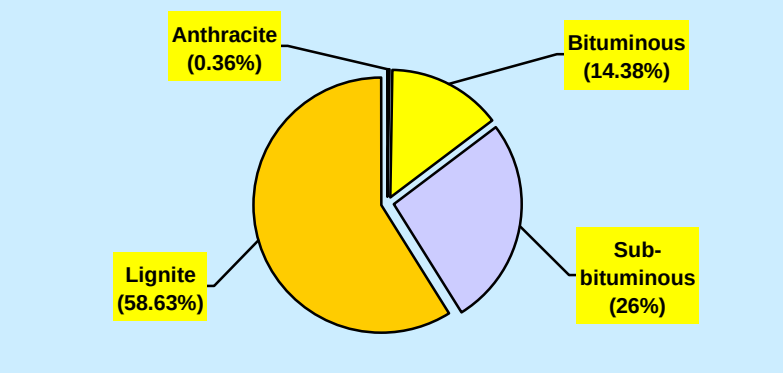
Indonesia's coal is reported to be 38.8 billion tons (as of 1998), of which measured reserves amount to 11.56 billion tons (Table 1). The coals range in age from Pliocene to Permo-Carboniferrous, but the majority relatively young Tertiary deposits, from the Miocene. The majority of Indonesia's coal is lignite (58.63%) followed by subbituminous (26.63%), and bituminous (14.38%), as shown Figure 1. They have medium calorific value (3,815-6,800 kcal/kg), and high moisture (9 - 35%), low ash (1 -19%), and low sulfur (0.1 - 0.9%) content.

Table 1 Indonesian Coal Resources

Million tones

Region	Mineable	Measured	Indicated	Total
Sumatera	2,863.15	4,902.03	12,599.28	17,501.31
Kalimantan	2,505.03	6,640.08	14,392.76	21,217.96
Java	0.00	0.63	4.86	5.49
Sout Sulawesi	0.00	0.00	21.20	117.33
Papua	0.00	0.00	25.53	25.53
Others	0.00	5.42	7.31	12.73
Total	5.368.18	11,568.73	27,306.13	38,874.86
Total Production (1937-1999)	440.02	0.00	0.00	0.00
Tot. unexploited	4,928.16	11,568.73	27,306.13	38,874.86

Source: Directorate of Coal, 2000



Source: Directorate of Coal

Figure 1 Distribution of coal by rank

At present, 95% of Indonesia's coal production is mined by open pit mining methods, most by conventional truck and shovel operations. Underground mining is found at Ombilin (West Sumatra), Kitadin, and Fajar Bumi Sakti (East Kalimantan).

Coal Mining Industry Structure

A feature of the Indonesian coal industry has been the use of contractors to carry out the mining and hauling as a result of their being a number of such contractors and contracting minimizes capital

investment in first years of operation. They are often also associated with construction work, and the quality of these contractors.

The players in the coal mining development in accordance with Basic Law No. 11 of 1967, can be divided into the following four groups:

- the state coal company,
- coal contracting companies
- mining authorization (KP) holders
- cooperative units

Table 2 Indonesian coal production by group, 1995 - 1999

Million tones

Mines	1995	1996	1997	1998	1999
PTBA	7.98	9.23	9.96	9.86	11.21
Coal Contractor	30.98	37.82	40.60	47.28	57.59
KP holder	4.50	3.54	4.08	4.85	4.72
Cooperative Units	0.28	0.38	0.17	0.27	0.13
Total	41.84	50.35	54.87	62.27	73.65

Source: Directorate of Coal, 2000

Table 3 Indonesian coal domestic sales and exports, 1995-1999

Million tones

	1995	1996	1997	1998	1999
Domestic sales	9.21	11.25	13.41	19.60	18.74
Export	31.32	36.38	41.73	47.51	55.18

Source: Directorate of Coal, 2000

The current status and number of coal companies in Indonesia is as follows:

PT. Tambang Batubara Bukit Asam (PTBA) now merged with PN Tambang Batubara operates two mines namely Ombilin (West Sumatra) and Tanjung Enim (South Sumatra).

Contractors:
This group comprises 150 companies, permitted less than four "generations" of CCoW:

- Generation 1: 10 in the production stage (all but 2 are foreign companies), located in Kalimantan (9) and in Sumatra (1);
- Generation 2: 5 in production stage, 1 in the construction stage, 2 under feasibility study, and 1 in the exploration stage, located in Kalimantan (13) and in Sumatra (4);
- Generation 3: 68 signed contracts with the government in November 1997, while 14 signed contracts with the government in February 1998 (7 are foreign companies), and 28 signed contracts in March 1999; 3 of them have been granted presidential approval, and 6 signed the contract for ex CHOMD area; 15 of them have been terminated.
- Generation 4 includes: 28 companies, 8 of them were terminated.

KP (mining authorization) holders. KP holders comprise a total of 104 companies; 48 in the exploration stage, 28 in the exploitation stage, and 32 in the development process from exploration to exploitation. Cooperative units. There are 11 active in the production stage and about 7 in the development stage.

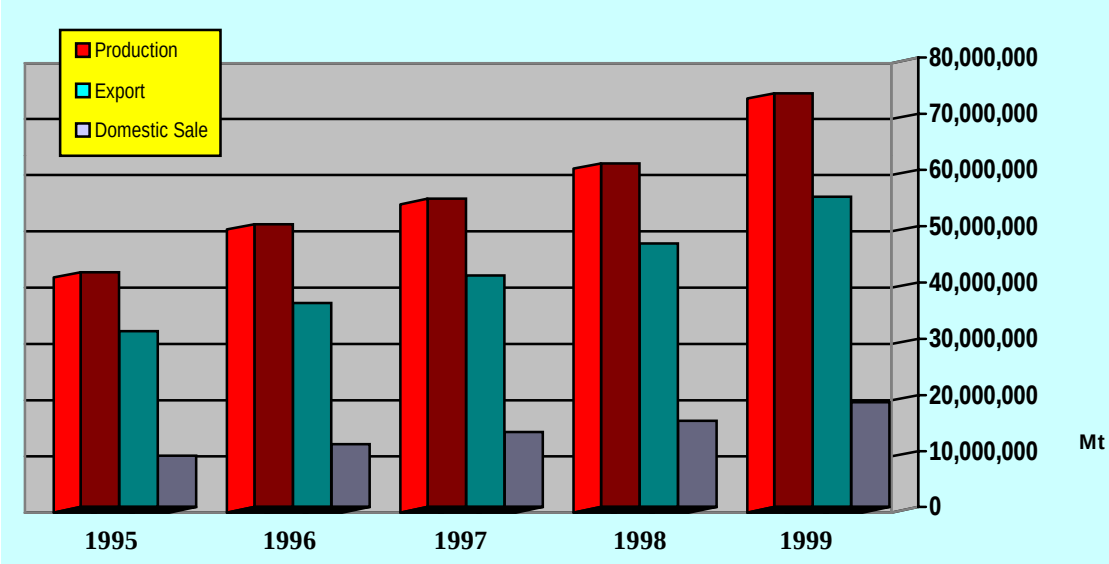
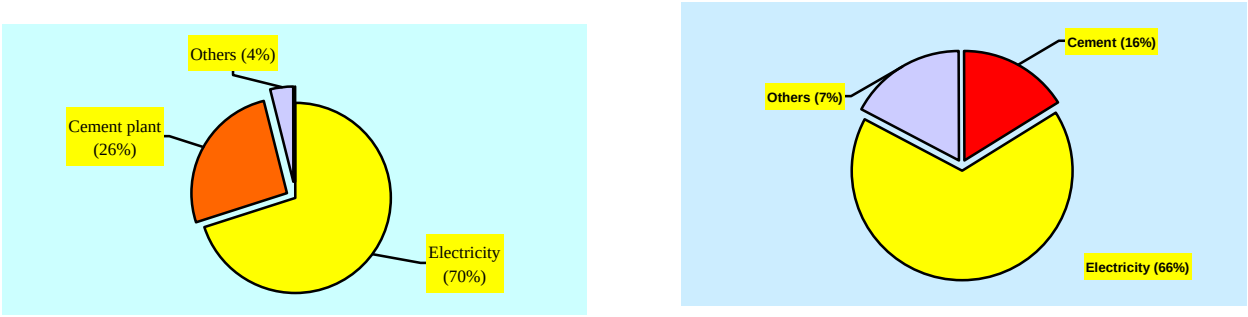


Figure 2 Indonesian coal production, domestic sales, and exports, 1995-1999

During the five year (1995-1999), the average annual growth rate of Indonesia coal production is 14.75% (Figure 2), while the annual growth rates for domestic sales 24% (Figure 3) and 24% for exports (Figure 4).



1995: 9.21 Mt **1999: 18.74 Mt**

Figure 3 Shares of domestic coal consumption by major consumers, 1995-1999

1995: 31.319 Mt 1999: 55.181 Mt

Figure 4 The changing coal export pattern, 1995-1999

Transportation and Infrastructure

In coal development, generally the first challenge to be faced is the development of a delivery system to link the coalmine to the domestic or overseas consumers (coal chain). A typical coal chain for an end consumer may be illustrated as: mine site - transport - port stockpile - barge/ship/rail/truck loading - stockpile - coalbunker.

Infrastructure requirements for an Indonesian coal mine include access to the mining area, coal handling/preparation facilities, facilities to transport the coal from the mine to a stockyard, a facility to load product coal onto either barge, rail, or ocean going vessels, and ancillary support facilities such as power and water supplies, communications, housing, and a trained work force.

Coal production in Indonesia practically is limited exclusively to the islands of Kalimantan and Sumatra. Coal distribution flow in mainly directed at the domestic consumers in Java and toward exports. The system in which coal is transported from the coalmine to the loading port differs between Kalimantan and Sumatra. Whereas Kalimantan uses truck and barges, Sumatra relies primarily on trucks and railway transportation.

The development scenario involves both expansion of the capacity of roadways, waterways (barges), and railways for domestic coal flow and the capacity of deepwater terminals for export purpose.

Coal terminals with sufficient capacities are a prerequisite for international coal trade. Existing coal ports in Indonesia (Tanjung Bara, North Pulau Laut, Balikpapan, Tanjung, and Tarahan among others) have throughput of 80 million tonnes per annum.

Prices

Export coal prices are normally determined through buyer - supplier negotiations although benchmark prices are used as a reference. In the last quarter it is reported that export prices (spot basis) varied between US 24.00 - 24.50/ton. Domestic prices are lower than export prices, due to special arrangement (between the PTBA and contractors as suppliers and the PLN, State Electricity Company as buyer).

Environmental Restriction on Coal-Fired Plant

With the progress in economic growth and industrialization, environmental pollution of air and water has become a problem in large cities such as Jakarta, Bandung, and Surabaya in Jawa. Concerning this matter, a Ministerial Decree on standard of emission to air in coal-fired plants (Kepmen LH No.13) has been issued in 1995 (Table 4).

Table 4 Standard of Emission to Air in Coal-fired Power Plants

Parameters (mg/m3)	1995-2000 mg/m3	2000
Suspended particle matter	300	150
SO2	1,500	750
NO2	1,700	850
Opacity	40%	20%

The Role of Coal in Indonesia's Economy

The extensive development in Indonesia coal industry in the fifteen years has already made a strong positive impact economy-wide. Of particular importance is the contribution of foreign investment to the development of new coalmines. These investments have led to the opening up of the new coal-centered economic activities in East and South Kalimantan, the creation of new employment opportunities, the advancement of professional and managerial capabilities of Indonesians, and the use of domestic services and domestically produced goods.

In 1999 the coal mining industry provided direct employment for 30,944 people (203 of whom are expatriates) in various levels of job categories. Besides providing new employment opportunities, the development of new coalfields in remote regions has enhanced regional development and spread of economic activities throughout the country.

Actual investment by contractor companies of Generation 1 and 2 in 1999 amounted to US$ 83,379,257.73 and Rp 160,831,333,156.00, and the cumulative investment during 1982-1999 amounted to US$ 3,144,123,574.59 and Rp 1,769,479,720,872.00. State revenue (tax and non-tax) in 1999 amounted to US $ 152,362,041.48 and Rp 1,047,049,165,070.00.

Indonesia plays an important role in the steam coal trade as the Indonesian coal industry continues to grow. Although Indonesia coal reserves are quite large, the availability of high quality bituminous coal is restricted. After 2000, export capacity is expected to increase and will require foreign investment capital. The existing financial and political downturns have made the prospect of attracting further capital investment more uncertain and the scale will depend upon the recovery in domestic demand and the perceived sovereign risk associated with foreign investment in the country. The decline demand is making more capacity available for exports in the short time.

NATURAL GAS

Utilization of natural gas as fuel and raw material domestically shows increasing trend. However, monetary crisis that started in the middle of 1997 caused depreciation of Rupiah significantly that led to decrease in domestic utilization. With normal price (no subsidy and incentive), it will be hard for gas to compete with other energy, since oil to be substituted is subsidized.

Domestic utilization of gas gives significant added value for the state. Since gas was priced in Dollar, and Rupiah were depreciated due to monetary crisis, then price of domestic gas was high.

Indonesian gas resources

Gas resources of Indonesia showed an increase in the last five years, namely from 293.24 trillion cubic feet (TCF) or 48.87 billion barrels equivalent of oil (BOE) in 1995 to 332.13 TCF or 55.35 BOE in 1998. The increase in gas resources resulted from the discovery of new potential areas. Gas reserves increased significantly in the 1995-1999 period, namely from 123.6 TCF in 1995 to 158.3 TCF in 1999. The oil and gas resources potentials are accumulated in 60 sedimentary basins, which are located in various places all over Indonesia. Out of the 60 sedimentary basins, only 38 basins have been explored, while the remaining 22 basins have not been explored, 14 basins have produced hydrocarbons (3 basins are located in East Indonesia and the other 11 basins are located in Western Indonesia), 9 basins have discovered hydrocarbons but not yet producing, and the remaining 15 basins have been drilled with no discovery so far.

Table 5 Oil and Gas Resources 1995-1999

Resources	1995	1996	1997	1998	1999
Oil (BBO)	69,55	71,13	73,30	77,34	84,48
Gas (BBOE/TCF)	48,87/293,24	49,71/296,87	51,32/307,95	55,35/332,1	64,05/384,28
Total	118,32	120,60	124,62	132,69	148,53

Table 6 Fields on Exploration Stage

CONTRACTORS (OPERATORS)	BLOCKS	LOCATIONS	AREAS	ACTIVITIES
ARCO	Senoro Toili	Offshore	East Kalimantan	Regional Study
EXPAN SUMATERA	Pasemah Block	Offshore	South Sumatera	Prospect Evaluation
GFB RESOURCES	Bawean	Offshore	Jawa Timur	Prospect Evaluation and Seismic Interpretation
	NE. Natuna	Offshore	Natuna Sea	Prospect Evaluation and Seismic Interpretation
LASMO	Malagot PSC/JOB	Offshore	Irian Jaya	Prospect Evaluation and Seismic Interpretation
	Selat Malaka	Offshore	Sumatera Utara	Prospect Evaluation and Seismic Interpretation
CANADIAN PETROLIUM	Manna	Offshore	SW Sumatera	Regional Study, Seismic
	Seram	Offshore	Maluku	Prospect Evaluation and Seismic Interpretation
SANTOS	Sampang	Offshore	Jawa Timur	Regional Study and Seismic Interpretation
GULF INDONESIA RESOUCES	Tungkal	Offshore	Sumatera Selatan	3D Seismic Processing
	Sakala	Offshore	Jawa Timur	Regional Study and Seismic Interpretation
	Merangin	Offshore	Sumatera Selatan	Geology Evaluation and Seismic Interpretation
	Ketapang	Offshore	Jawa Timur	Regional Evaluation and Seismic re-processing
SANTAFE	Bangko	Offshore	Sumatera Selatan	Regional Study and Seismic Interpretation
	Pagatan	Offshore	Kalimantan Timur	To be taken over by Amerada Hess, Waiting for the approval of BPPKA
COPAREX BLORA BV.	Blora	Offshore	Jawa Timur	Regional Study relating to data of well Rembang-1
PREMIER OIL	Pangkah	Offshore	Jawa Timur	Seismic Processing
SANTOS	Sampang	Offshore	Jawa Timur	Regional Study and Seismic Interpretation
TALISMAN	Madura	Offshore	Jawa Timur	Economy Study and Seismic Interpretation
SHELL	Bukat		Kalimantan Timur	Seismic Interpretation
	Sembawang II		Kalimantan Timur	Regional Evaluation

Table 7 Producing Basins

Western Indonesia	Eastern Indonesia
1. N. Sumatra 2. C. Sumatra 3. S. Sumatra 4. Sunda 5. N.W. Java 6. N.E. Java Sea 7. N.E. Java 8. W. Natuna 9. Tarakan 10. Kutai 11. Barito	12. Seram 13. Salawati 14. Bintuni

Table 8 Drilled Basins, Discovery, Not Yet Producing

Western Indonesia	Eastern Indonesia
1. Sibolga	5. Bone
2. E. Natuna	6. Bangai
3. Bengkulu	7. Sula
4. Pati	8. Biak
	9. Timor

Source: Directorate General Oil and Gas MME

Natural gas production and utilization

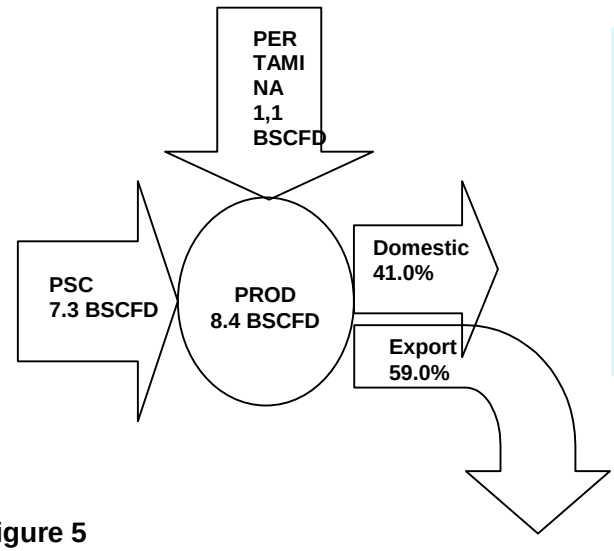
In the period of 1995-1999 total natural gas production was 15.4 TCF or an average of 3.1 TCF per year. In the same period gas utilization was 14.4 TCF or an average 2.9 TCF per year (Table 5).

Table 9 Natural Gas Production and Utilization 1995-1999

MSCF

Year	Production	Utilization	Percentage
1995	2,999,229,427	2,835,270,331	94.53
1996	3,164,016,189	2,987,594,136	94.42
1997	3,166,034,892	2,975,183,894	93.97
1998	2,978,851,873	2,785,113,991	93.50
1999	3,043,074,529	2,859,741,326	93.98

Source: Directorate General Oil and Gas (MME)



	MMSCFD	(%)
FERTILIZER	597,5	7,1
REFINERY	154,0	1,8
LPG*)	23,1	0,3
PGN	122,2	1,5
CEMENT	2,8	0,1
ELECTRIC	620,0	7,4
KRAKATAU STEEL	83,0	1,0
OTHER INDUSTRIAL	75,6	0,9
OWN USE	1053,4	12,5
FLARED/LOSSES	709,2	8,4
	3.444,8	41,0

LNG 4,956.0

Figure 5
Indonesian Natural Gas utilization, 1999

Indonesia's gas plants capacity

Natural gas processing is mainly conducted in the gas plants, which process natural gas into liquefied natural gas (LNG). The installed capacity of LNG plants is 34.49 million Mt/annum, consists of:

1) Arun LNG Plant (6 trains) with a capacity of 12.85 million Mt/annum;
2) Badak LNG Plant (8 trains) with a capacity of 21.64 million Mt/annum.

The installed capacity of LPG plants is 2.775 MMT/annum, while total production refineries capacity is 3,668 MMT/annum (see Table 10)

Table 10 LPG Production during 1995-1999

M. Ton

Year	Gas Plant
1995	2,346,355.80
1996	2,560,353.47
1997	2,101,967.76
1998	1,728,095.17
1999	1,657,782.08

Gas plants production

LNG production came from Arun LNG Plant and Badak LNG Plant. LNG production in 1995 was 25.2 million tons, and increased to 29.5 in 1999 due to construction of two new trains (trains G and H) in Badak LNG Plant. Arun LNG Plant is capable of operating at 138% above its design capacity, whereas Badak LNG Plant is capable to operate at 132% above its design capacity (Table 11).

Table 11 Indonesian LNG Production

Mt

Year	Arun	Badak	Total
1995	11.540.393,32	13.675.215,26	25.215.608,58
1996	11.355.030,36	14.906.800,46	26.261.830,82
1997	11.522.701,81	15.613.969,42	27.136.671,23
1998	10.844.736,45	16.335.170,82	27.179.907,27
1999	11.416.606,77	18.395.767,38	29.812.374,15

Source: Directorate General Oil and Gas, MME

Petrochemical products produced from gas processing are methanol, urea, and ammonia, which are raw material for adhesive, fertilizer etc. industries. Pertamina petrochemical plants which utilized oil and gas, as raw materials are the Methanol Plant in Bunyu Island (East Kalimantan), Purified Terephtatic Acid (PTA) Plant in Plaju (South Sumatra), and Paraxylene and Benzene Plants in Cilacap (Central Java).

Gas utilization for transportation

In the framework of energy diversification in oil and gas, the National Energy Coordination Agency (BAKOREN) decided on January 1986 to utilize compressed natural gas (Bahan Bakar Gas, BBG) as fuel for motor vehicles to replace gasoline and diesel oil, particularly for taxi and microlets in Jakarta.

BBG sale began in August 1987. Some benefits of BBG are it is environmentally friendly and it contributes to the gradual reduction of petroleum fuels. Currently, the public gas (BBG) stations are in operations in Jakarta, Bogor, Bandung, Surabaya, and Medan. The total BBG sale in 1999 amounts to 37,760,000 LSP (Liters of Premium Equivalent), while the average sale between 1995-1999 amounted to 22,994,997 LSP per annum.

LNG exports

LNG export during the last five years increased by an average of 9.85% per annum due to increase in LNG production in Bontang (Table 12).

Table 12 LNG Exports 1995-1999

Year	Volume (Ton)	Value (Milion US$)
1995	2551,581	471.1
1996	2,712,253	547.9
1997	2,132,917	516.2
1998	1,761,304	257.1
1999	1,515,801	284.0

Source: Directorate General Oil and Gas, MME

*) Temporary Figures

Prices

Different from oil and coal, since natural gas should be transmitted to end-users or to be converted to LNG, its market is limited and requires long-term contract. Further, not like crude oil, it does not have international free market price.

Government policy in domestic pricing for gas allows gas to achieve its economic price. However it is a dilemmatic matter, for when the price is set high, gas cannot be utilized domestically to promote economic growth. On the other hand, if the price is low, it will not be attractive for investors to undertake upstream business (exploration and exploitation).

In order to protect steel industry, government offers subsidized price to the steel industry where gas is used as raw material. For the same reason, fertilizer plants also enjoy the subsidized gas price,

so government can control rice price domestically. Examples of domestic prices can be given as: to PLN (State Electricity Company) they varied from US$ 2.45-3.00/MMBTU, fertilizer plants varied from US$ 1.00-1.50/MMBTU, and PGN (State Gas Company) Rp. 3,100.00/MMBTU.

The Role of Gas in Indonesia's Economy

In 1999, oil and gas mining industry provided direct employment for 35,304 people in various levels of job categories. State income from gas alone in 1999 is estimated to be Rp. 8,521,600,000,000.00 (6% of State Budget and Expenditure FY 1999-2000).

The utilization of natural gas is still very small compared with national potential. Monopoly in ownership of gas transportation net and sale right both for export and domestic use may hinder investors to participate in gas development undertaking. Other factor is subsidized price of fuel oil.

Role of Coal and Gas in Energy Mix

The actual domestic primary energy consumption which consisted of crude oil, natural gas, coal, hydropower, and geothermal in the period of 1995-1999 shows an increase, except in 1998 where it experienced a decrease (see Table 13).

The actual domestic energy consumption in the 1995-1999 period increased by an average of 5.2% per annum, namely from 496.5 million BOE to 600.5 million BOE. There was an increase in consumption of each type of energy, except hydropower, which suffered a decrease. In 1998 there was a decrease of 1.8%, namely from 578.4 million BOE in 1997 to 567.7 million BOE due to decrease in oil, gas, and coal consumption. As in the case of primary energy, the actual final energy consumption in 1995 through 1999 shows an increase by an average of 5.1% per annum, namely from 332 million BOE to 399.8 million BOE. However, in 1998 there was a decrease in the industrial and transportation sectors.

The actual consumption of natural gas in 1995-1999 increased by an average of 4.8% per annum, namely from 134.3 million BOE to 160.2 million BOE, except in 1998 when it decreased due to the decrease in natural gas utilization in industrial sector.

The actual consumption of coal during the period of 1995-1999 shows an average increase of 9.6% per annum, except in 1998 namely from 41.6 million BOE to 58.4 million BOE due to increase in industrial sector and electricity generation.

Table 13 Primary Energy Consumption by Type 1995-1999

1000 BOE

Year	Oil	%	Gas	%	Coal	%	Hydro	%	Geot.
1995	290,013,0	58.4	134,318.6	27.1	41,617.2	8.4	26,349.5	5.3	4,200,0
1996	304,006,2	57.7	145,407.2	27.6	46,232.1	8.8	27,120.6	5.1	4,545,3
1997	342,845,9	59.3	150,810.0	26.1	58,647.6	10,1	20,691.6	3.6	5,424.1
1998	333,534,5	58.7	144,082.3	25.4	55,818.3	9.8	26,922.7	4.7	7,435.2
1999	353,113,0	58.8	160,222.8	26.7	58,393.3	9.7	21,252.4	3.5	7,522.0

Source: Directorate General Oil and Gas, MME

Table 14 Final Energy Consumption by Type 1995-1999

1000 BOE

Year	Industry	%	Household	%	Transportation	%	Total
1995	131,499.9	39.5	77,151.1	23.2	123,907.4	37.3	332,558.4
1996	138,956.8	38.6	83,641.0	23.2	137,640.7	38.2	360,238.5
1997	146,721.4	37.8	88,374.1	22.8	153,092.4	39.4	388,187.9
1998	136,653.9	36.2	91,704.0	24.3	149,594.6	39.6	377,952.5
1999	145,372.9	36.4	102,868.4	25.7	151,585.1	37.9	399,826.4

Source: Directorate General Oil and Gas, MME

CONCLUDING REMARKS

The importance of coal and natural gas to meet ever-increasing energy demand in Indonesia has been addressed. Although coal and natural gas compete each other, they also have to be complementary to achieve higher goal, which is the maximum benefit for the society.

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1997	342,845,9	59.3	150,810.0	26.1	58,647.6	10,1	20,691.6	3.6	5,424.1	0.9	578,419.2
1998	333,534,5	58.7	144,082.3	25.4	55,818.3	9.8	26,922.7	4.7	7,435.2	1.3	567,793.0
1999	353,113,0	58.8	160,222.8	26.7	58,393.3	9.7	21,252.4	3.5	7,522.0	1.3	600,503.5

Source: Directorate General Oil and Gas, MME